








Submerged pump

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Cited documents:

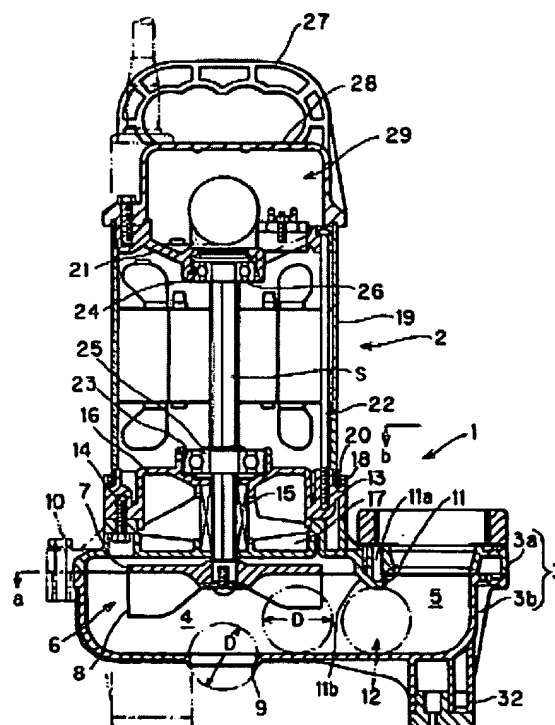
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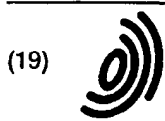
Abstract of EP0754865

There is disclosed a submerged pump used, for example, in a duplex treating tank for sewage. The submerged pump includes a pump casing (3) including an inlet portion (9), a pump chamber (4) and a discharge portion (5), a motor means (2) for driving and rotating an impeller provided in the pump chamber (4); the motor means being integrally secured to the pump casing (3), wherein the pump casing (3) comprises at least two subcasings (3a,3b) assembled together, at least one of the subcasings (3a) having a projection (11) defining a narrowed passage (12) portion.

FIG. 1



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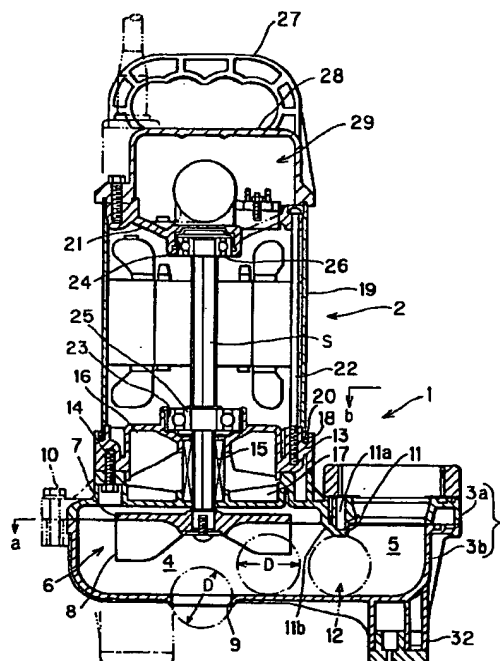
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(54) Submerged pump

(57) There is disclosed a submerged pump used, for example, in a duplex treating tank for sewage. The submerged pump includes a pump casing (3) including an inlet portion (9), a pump chamber (4) and a discharge portion (5), a motor means (2) for driving and rotating an impeller provided in the pump chamber (4); the motor means being integrally secured to the pump casing (3), wherein the pump casing (3) comprises at least two subcasings (3a,3b) assembled together, at least one of the subcasings (3a) having a projection (11) defining a narrowed passage (12) portion.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

Field of the Invention:

The present invention relates to a submerged pump for use, for example, in a treatment tank for a multiple sewage system. Description of the Related Art:

Japanese Laid-Open Utility Model Application No. 5-14590 discloses a submerged pump in which a motor housed in a stainless steel motor frame is combined with a pump casing made of synthetic resin. In this submerged pump, a so-called open-type casing is employed, which is made by assembling a plurality of casing elements or subcasings, for production and maintenance convenience.

One of the problems of the above-discussed pump is how to prevent a foreign object from clogging in a flow passage or being caught by an impeller. In order to solve the problem, a narrowed passage portion or a bottle neck portion having a diameter smaller than that of an inlet portion is excluded along the flow passage of the pump.

Conventionally, an upper casing and a lower casing, which make up the pump casing, are molded with resin in a manner that surfaces facing each other is flat and parallel. Thus, since a diameter of a boundary portion between a pump chamber and a discharge portion is larger than that of the inlet portion, an internal energy loss of the fluid due to a variation in fluid pressure reduce not only pumping efficiency but also a head pressure at a shut off operation flow rate.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a submerged pump having a casing made of resin for reducing its weight and production cost, which can maintain a high pumping efficiency and prevent lowering of head at a shut off operation flow rate.

According to a first aspect of the present invention, there is provided a submerged pump comprising a pump casing accommodating a shaft rotatably therein and having an inlet portion, a pump chamber and a discharge portion; an impeller integrally mounted on said shaft in said pump chamber; and a motor means for driving said impeller to rotate within said pump chamber, said motor means being integrally secured to said pump casing; wherein said pump casing comprises at least two subcasings assembled together, at least one of said subcasings having a projection defining a narrowed passage portion between said pump chamber and said discharge portion.

According to the first aspect of the present invention, even when the pump casing is made of resin, pumping efficiency is maintained and loss of head is decreased at a shut off operation flow rate.

In the above invention, a minimum diameter of the

narrowed passage portion may be equal to or a little larger than a minimum diameter of the inlet portion of the submerged pump. According to the invention, a foreign object entering from the inlet portion is prevented from being entrapped at the narrowed passage portion.

In the above invention, a gap having a diameter equal to or larger than a minimum diameter of the inlet portion may be formed between the impeller and the pump casing. According to the invention, the foreign object is prevented from being entrapped between the impeller and the casing.

In the above invention, a cross-sectional area of the narrowed passage portion may be almost equal to that of the inlet portion. According to the present invention, the cross-section of the flow passage does not change substantially and loss of pressure is prevented.

In the above invention, an air vent hole penetrating an outer side wall of the pump chamber may be formed therein, in a manner that the air vent hole is at an obtuse angle with respect to a fluid flow direction in an outer portion of the pump. According to the invention, the air venting function is maintained and fluid leakage and wear of a periphery portion of the hole are reduced.

In the above invention, the highest contacting face between the subcasings may be arranged approximately as high as or higher than a main shroud of the impeller.

It is another aspect of the present invention to provide a submerged pump comprising a pump casing accommodating a shaft rotatably therein and having an inlet portion, a pump chamber and a discharge portion; an impeller integrally mounted on said shaft in said pump chamber; and a motor means for driving said impeller to rotate within said pump chamber, said motor means being integrally secured to said pump casing; wherein an air vent hole is formed through an outer side wall of said pump chamber, said air vent hole being at an obtuse angle with respect to a fluid flow direction in an outer portion of said pump.

According to the present invention, the air venting function is maintained and fluid leakage and wear of a periphery portion of the hole are reduced.

In the above invention, an angle between the air vent hole and the fluid flow direction may be substantially in a range of 105 to 165°. When the angle is under 105°, reduction of fluid leakage and wearing is not significant. On the other hand, when the angle is over 165°, thickness of the wall around the hole is thin, which lowers a mechanical strength of the wall.

Also, it is another aspect of the present invention to provide a vortex-type submerged pump comprising a pump casing accommodating a shaft rotatably therein and having an inlet portion, a pump chamber and a discharge portion; an impeller integrally mounted on said shaft in said pump chamber; and a motor means for driving said impeller to rotate within said pump chamber, said motor means being integrally secured to said pump casing; wherein said pump casing comprises at least two subcasings assembled together, the highest

contacting face between said subcasings is arranged approximately as high as or higher than a main shroud of said impeller.

The above and other objects, features, and advantages of the present invention will become apparent from the following description when taken in conjunction with the accompanying drawings which illustrate preferred embodiments of the present invention by way of example.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A is a sectional view showing a submerged pump of an embodiment of the present invention;
FIG. 2A is a sectional view taken along the line a of FIG. 1;
FIG. 2B is a sectional view taken along the line b of FIG. 1;
FIG. 3A is a plan view showing a lower casing; and
FIG. 3B is a side view showing the lower casing.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Hereinafter, a preferred embodiment of the present invention will now be described in detail.

FIG. 1 shows an embodiment of the submerged pump of the present invention. As shown in FIG. 1, the submerged pump comprises a pump body 1 and a motor 2 integrally provided on the pump body 1.

The pump body 1, as shown in FIG. 2A, includes a pump casing of resin, in which a pump chamber 4 and a discharge portion 5 are formed. A main shaft S of the motor 2 is inserted into the pump chamber 4 and provided with an impeller thereon. Vanes 8 are formed only on one side of the main shroud 7 of the impeller 6, to construct a so-called vortex-type pump. In a bottom face of the casing 3, an inlet portion 9 is formed.

The pump casing 3 comprises two casing elements or subcasings, that is, an upper casing 3a and a lower casing 3b assembled together by bolts 10. These subcasings 3a, 3b are respectively formed by resin molding to make up so-called open-type casings.

The upper casing 3a has, as shown in FIG. 2B, a projection portion 11 projecting downwardly below a boundary portion between the pump chamber 4 and the discharge portion 5. A lower end of the projection portion is formed to have a circular ridge line, which defines a narrowed passage portion also of a circular cross-section. The projection is formed to have a hollow space therein for reducing the amount of material resin as well as its weight. The projection 11 is formed with a slope 11b on a side facing the pump chamber 4 so as to prevent generation of turbulent flow at the narrowed passage portion. A diameter D of the narrowed passage portion 12 is equal to that of the inlet portion 9 and to a distance between a lower edge of a vane 8 of the impeller 6 and the bottom face of the pump casing 3, which defines a minimum diameter of the flow passage of the

pump.

In the impeller 6 of the pump, some (in this example, two) of the vanes are designed to be have more width of height towards the bottom surface than the other vanes so as to improve pumping performance. Although a distance between a lower edge of the wider vanes and the bottom surface of the casing is less than the distance D, a gap is maintained between the vanes, through which a sphere having a diameter D can pass, so as to prevent the foreign object flowing from the inlet portion from being entrapped.

A bearing bracket 13 made of resin is secured by a bolt 13 on the upper portion of the upper casing 3a facing the pump chamber 4. Between the upper casing 3a and the bearing bracket 13, a mechanical seal element 15 is provided around the main shaft S. On both an upper face of the upper casing 3a and a lower face of the bearing bracket 13, radial ribs 16, 17 are provided to extend radially to reinforce these members and prevent the lubricant from being scattered within the space. On the upper end of the cylindrical portion of the bearing bracket 13, a groove 18 extending in a peripheral direction is formed, in which an edge of a motor frame made of corrosion-resistant metal is inserted with a packing material 20.

The upper end of the motor frame 19 is also inserted in a groove formed on the lower surface of an upper bearing bracket 21 made of resin, which is secured to the lower bearing bracket 13 by long bolts 22. On the central portions of the upper and lower brackets 13, 21, recesses 23, 24 are formed to face each other, each of which accommodates a metal washer for securing bearings 25, 26 therein. On the upper bearing bracket 21, a cover 28 made of resin is attached, in which a power controller 29 for controlling the motor is provided.

The pump casing 3 is designed to be divided into upper and lower portions at as a high level as molding is possible. In this embodiment, the lower edge of the upper casing 3a is set at the same level as the lower face of the main shroud 7. The reason for this design is that the material resin of the upper casing 3a is required to be of a high performance compared to that of the lower casing 3b, and thus, is expensive. Therefore, the upper casing 3a should be made in a small size to reduce the production cost.

On the upper end of the lower casing 3b, an air vent hole 30 is formed through the side wall of the pump at an obtuse angle A to the fluid flow direction, as shown in FIGS 3A and 3B. This is to discharge air aspirated in the pump to prevent an air lock. Such an arrangement of the air vent hole 30 makes it possible to retard the enlargement thereof by increasing the mass of a corner portion 31, which is easy to wear because of friction between the fluid flow, thus leading to an elongated life of the pump, as well as to minimize fluid discharge from the air vent hole 30 to maintain pumping efficiency. In the lower face of the lower casing 3b, three legs 32 are formed by molding integrally therewith.

The submerged pump described above works as follows. When the submerged pump is placed in a water tank and the motor 2 is turned on, the fluid in the pump chamber 4 is energized in a centrifugal direction by the rotation of the impeller and flows into the discharge portion 5 through the narrowed passage portion 12. During the flow from the inlet portion 9 through the pump chamber 4 to the discharge portion 5, the cross-sectional area of the flow passage does not change extensively so as to minimize energy loss, which leads to improvement of the pumping efficiency. On the other hand, since the cross-sectional area of the flow passage decreases at downstream side of the impeller 6, the pump head can be enhanced at a shut off operation flow rate, that is, at a small flow rate range. This feature also serves to prevent an excess output in a large flow rate range.

According to the present invention, by preparing a projection defining a narrowed passage portion between the pump chamber and the discharge portion, pumping efficiency is maintained, and the head pressure is prevented from being lowered at a shut off operational flow rate, even when the pump casing is made of resin. Thus, the present invention can provide a pump having advantages of resin material open-type casing, such as light-weight, low cost and highly improved maintenance characteristics as well as a high pumping performance.

Also, by the air vent hole penetrating the outer side wall of the pump chamber being formed at an obtuse angle to the fluid flow in the outer periphery portion of the pump, leakage of the fluid and the wear of border of the hole are reduced, still maintaining the air vent function. Thus, the present invention can provide a pump having a high pumping efficiency and a long life.

Although a certain preferred embodiment of the present invention has been shown and described in detail, it should be understood that various changes and modifications may be made therein without departing from the scope of the appended claims.

According to its broadest aspect the invention relates on a submerged pump comprising:

a pump casing an impeller and a motor means for driving said impeller to rotate within said pump chamber.

Claims

1. A submerged pump comprising:

a pump casing accommodating a shaft rotatably therein and having an inlet portion, a pump chamber and a discharge portion;
an impeller integrally mounted on said shaft in said pump chamber; and
a motor means for driving said impeller to rotate within said pump chamber, said motor means being integrally secured to said pump

casing;

wherein said pump casing comprises at least two subcasings assembled together, at least one of said subcasings having a projection defining a narrowed passage portion between said pump chamber and said discharge portion.

2. A pump according to claim 1, wherein a minimum diameter of said narrowed passage portion is equal to or a little larger than a minimum diameter of said inlet portion of said submerged pump.

3. A pump according to claim 1, wherein a gap having a diameter equal to or larger than a minimum diameter of said inlet portion is formed between said impeller and said pump casing.

4. A pump according to claim 1, wherein a cross-sectional area of said narrowed passage portion is almost equal to that of said inlet portion.

5. A pump according to claim 1, wherein an air vent hole penetrating an outer side wall of said pump chamber is formed therein, said air vent hole being at an obtuse angle with respect to a fluid flow direction in an outer portion of said pump.

6. A pump according to claim 1, wherein the highest contacting face between said subcasings is arranged approximately as high as or higher than a main shroud of said impeller.

7. A submerged pump comprising:

a pump casing accommodating a shaft rotatably therein and having an inlet portion, a pump chamber and a discharge portion;
an impeller integrally mounted on said shaft in said pump chamber; and
a motor means for driving said impeller to rotate within said pump chamber, said motor means being integrally secured to said pump casing;
wherein an air vent hole is formed through an outer side wall of said pump chamber, said air vent hole being at an obtuse angle with respect to a fluid flow direction in an outer portion of said pump.

8. A pump according to claim 7, wherein an angle between said air vent hole and said fluid flow direction is substantially in a range of 105 to 165°.

9. A vortex-type submerged pump comprising:

a pump casing accommodating a shaft rotatably therein and having an inlet portion, a pump chamber and a discharge portion;

an impeller integrally mounted on said shaft in
said pump chamber; and
a motor means for driving said impeller to
rotate within said pump chamber, said motor
means being integrally secured to said pump 5
casing;
wherein said pump casing comprises at least
two subcasings assembled together, the high-
est contacting face between said subcasings is
arranged approximately as high as or higher 10
than a main shroud of said impeller.

10. A submerged pump comprising:

a pump casing an impeller and a motor means 15
for driving said impeller to rotate within said
pump chamber.

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FIG. 1

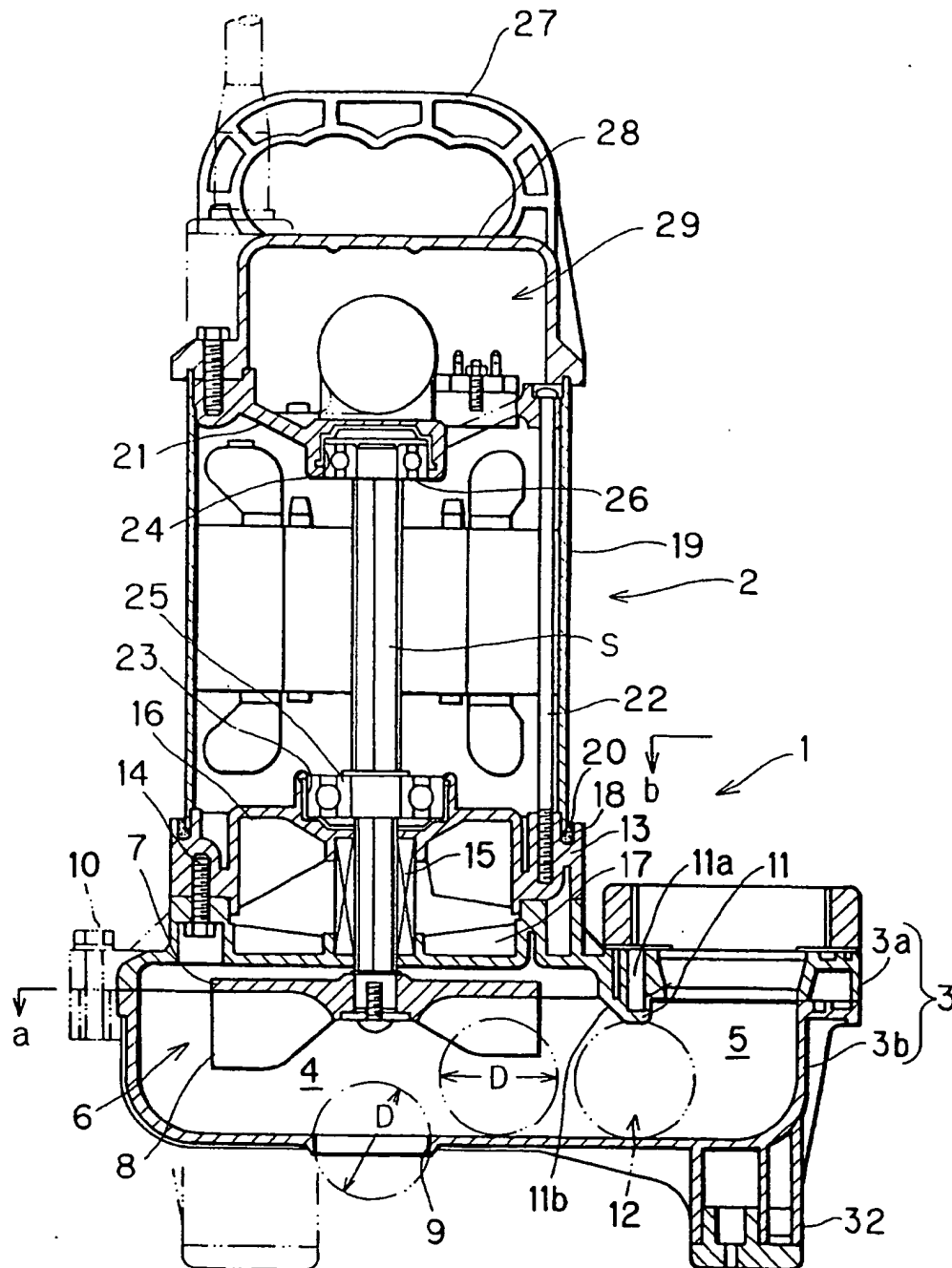


FIG. 2A

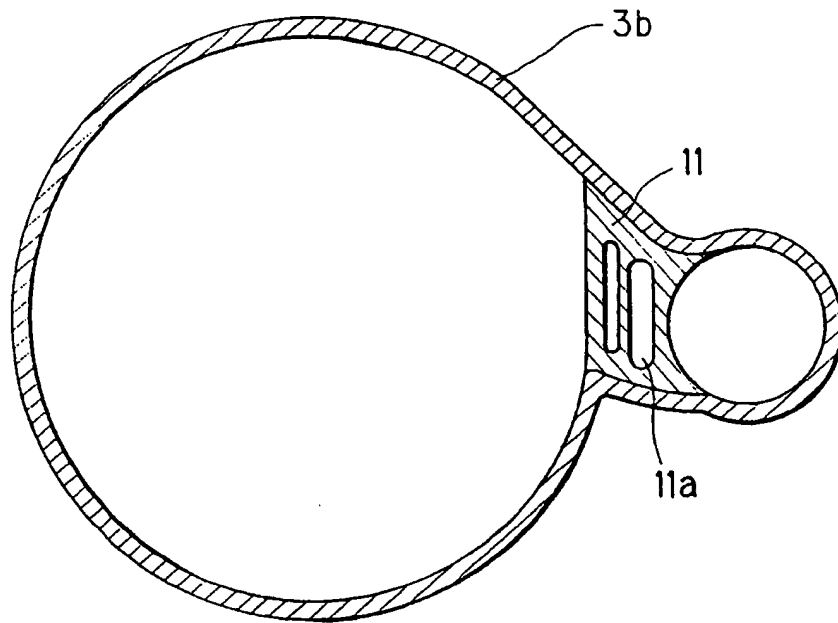


FIG. 2B

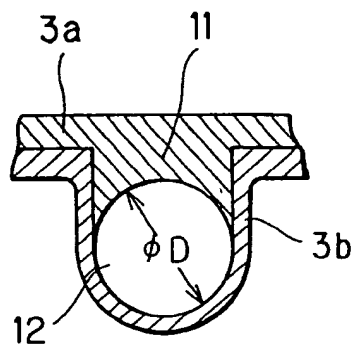


FIG. 3A

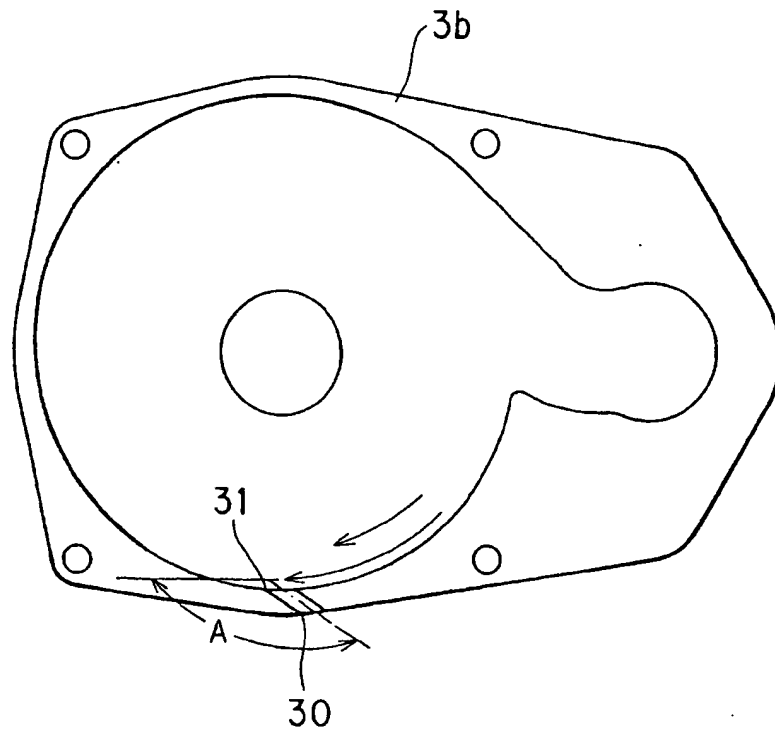
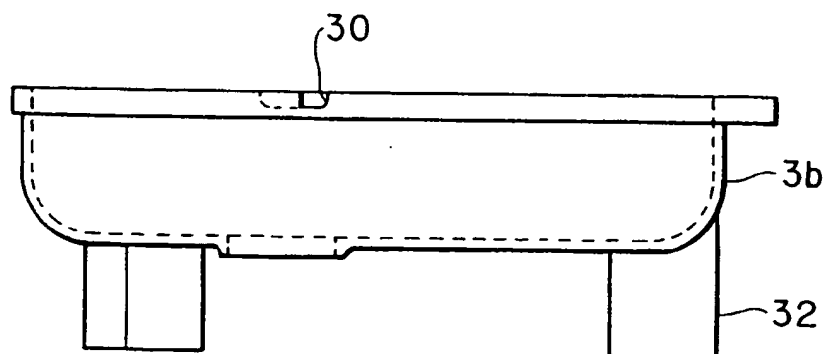
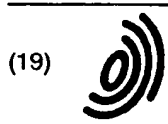


FIG. 3B





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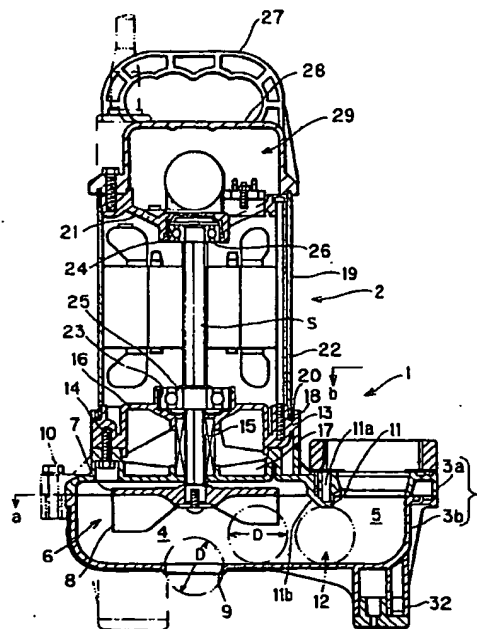
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(54) Submerged pump

(57) There is disclosed a submerged pump used, for example, in a duplex treating tank for sewage. The submerged pump includes a pump casing (3) including an inlet portion (9), a pump chamber (4) and a discharge portion (5), a motor means (2) for driving and rotating an impeller provided in the pump chamber (4); the motor means being integrally secured to the pump casing (3), wherein the pump casing (3) comprises at least two subcasings (3a,3b) assembled together, at least one of the subcasings (3a) having a projection (11) defining a narrowed passage (12) portion.

FIG. 1



EP 0 754 865 A3



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EUROPEAN SEARCH REPORT

Application Number
EP 96 11 1501

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	EP 0 391 352 A (EBARA CORP) * abstract *	1,10	F04D29/44 F04D13/08 F04D7/04 F04D9/00 F04D29/42
A	* column 8, line 58 - column 9, line 18; figures 10-12 *		
A	* column 5, line 34 - line 37; figure 4 *	6,9	

A	US 3 167 021 A (SENCE) * column 1, line 8 - line 10 *	1-4	
	* column 2, line 60 - column 3, line 20; figure 1 *		

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A	GB 612 573 A (VENNING) * figure 2 *	6,9	

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A	PATENT ABSTRACTS OF JAPAN vol. 006, no. 216 (M-168), 29 October 1982 & JP 57 122194 A (MATSUSHITA DENKO KK), 29 July 1982, * abstract *	5,7,8	

A	US 5 145 337 A (KIRKLAND DAN R) -----		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 10 February 1997	Examiner Zidi, K
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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European Patent Office

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims

- ☐ All claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for all claims.
- ☐ Only part of the claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claims:
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions, namely:

See sheet -B-

- ☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:



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EP 96 11 1501 - B -

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions, namely:

1. Claims 1-4,10: Submersible motorpump with a casing made of at least 2 parts one of them being provided with a projection defining a narrowed passage between the pumping chamber and discharge portion.
2. Claims 5,7,8 : Submersible motorpump with an air vent hole in the casing, drilled at an obtuse angle.
3. Claims 6,9 : Submersible vortex type motorpump with a casing comprising at least 2 subcasings the contacting surface between them at least as high as the main shroud of the impeller.